B.20 LER No. 309/83-002

Event Description: Transient with MFW Inoperable and One Isolated Steam Generator

Date of Event: January 25, 1983

Plant: Maine Yankee

B.20.1 Summary

On January 25, 1983, Maine Yankee tripped from a full load while isolating an electrical ground. Main feedwater (MFW) was unavailable after the trip and auxiliary feedwater (AFW) auto-started and provided cooling to the steam generators. Approximately 15 minutes after the trip, indications were received that a main feedwater line break had occurred. The estimated conditional core damage probability for this event is 8.6 x 10^{-5}.

B.20.2 Event Description

On January 25, 1983, Maine Yankee tripped from full load while an electrical ground was being isolated. Main feedwater was not available after the trip due to the trip of the turbine-driven pump and maintenance on both motor-driven pumps [NUREG-0090-Vol. 6-No.11]. Approximately 15 minutes later, a loud noise was heard in the plant machine shop, and a containment fire detector alarmed. Containment humidity also began to rise. The containment was entered for inspection and a feedline leak was discovered near the number 2 steam generator inlet nozzle. Station cooldown was initiated to permit close access for further inspection and repairs. Further investigation revealed that the leak likely occurred due to water hammer, which resulted in the failure of an existing crack in the feed pipe. The feedline leak was at most 100 gpm [NUREG-0090-Vol.6-No.11] and all AFW pumps were functional at the time of the incident.

B.20.3 Additional Event-Related Information

The Maine Yankee MFW system consists of one turbine-driven pump and two motor-driven pumps. AFW system consists of two motor-driven pumps and one turbine-driven pump. Any one of the three AFW pumps can supply sufficient water to remove decay heat from the steam generators.

B.20.4 Modeling Assumptions

This event was modeled as a transient with MFW failed. The MFW branch probability was set to failed, and the nonrecovery probability was set to 1.0 to reflect the likelihood that operators would not have been able to recover MFW within the allowable time during the transient.

The ~100 gpm leak rate experienced from the feedwater line to SG2 was relatively large compared to the output of a single AFW pump. Therefore, AFW success was assumed to require operation of two of three AFW pumps. The AFW branch failure probability was revised to reflect this.

B.20.5 Analysis Results

The estimated conditional core damage probability for this event is 8.6×10^{-5}. The dominant sequence, highlighted on the event tree in Figure B.20.1, involves a successful reactor trip, the failure of AFW, the failure of MFW, and the failure of feed and bleed.

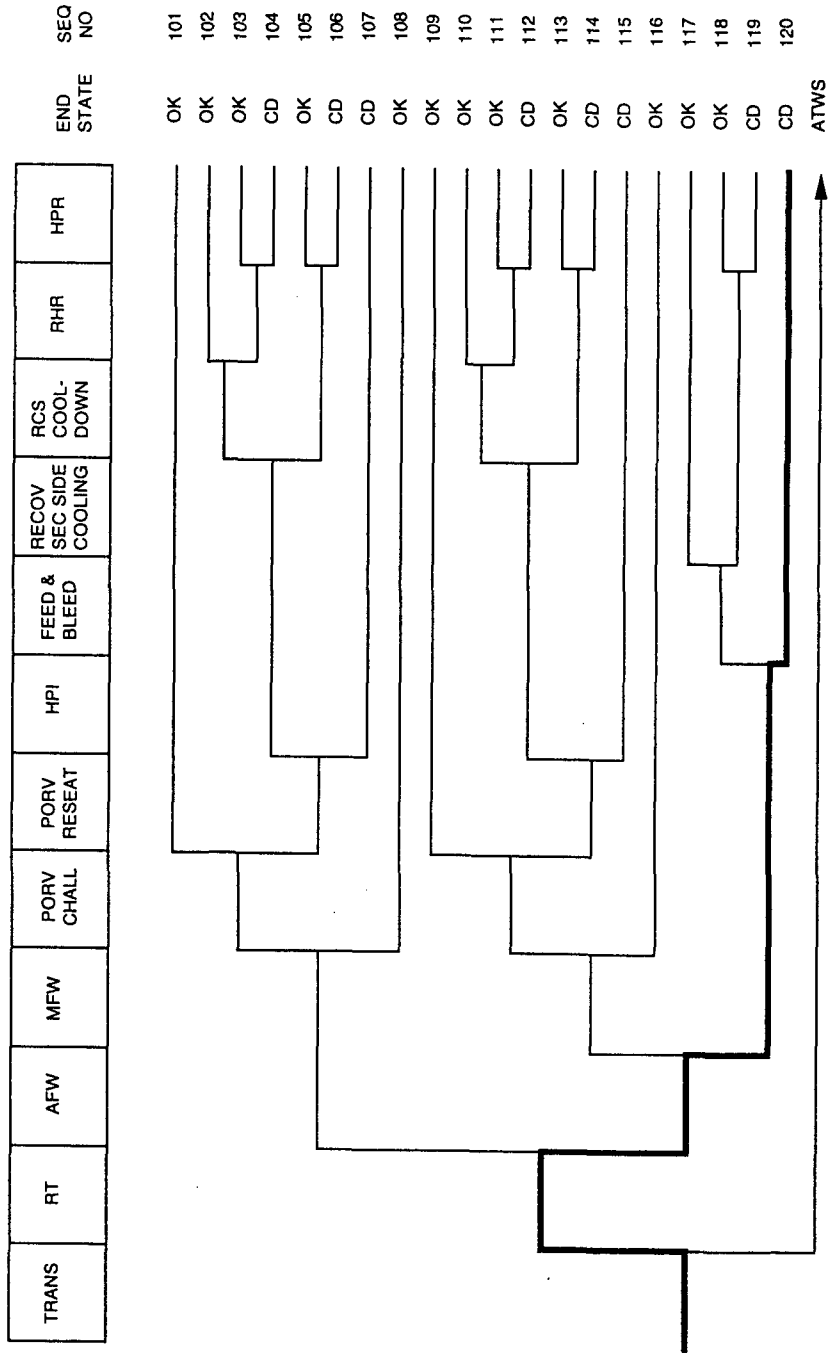

Figure B.20.1 Dominant core damage sequence for LER 309/83-002

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 309/83-002
Event Description: Transient with MFW inoperable and one SG isolated
Event Date: January 25, 1983
Plant: Maine Yankee

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	8.6E-05
Total	8.6E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
120	trans -rt afw MFW feed.bleed	CD	8.2E-05	4.5E-01
119	trans -rt afw MFW -feed.bleed recov.sec.cool hpr	CD	2.7E-06	4.5E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
119	trans -rt afw MFW -feed.bleed recov.sec.cool hpr	CD	2.7E-06	4.5E-01
120	trans -rt afw MFW feed.bleed	CD	8.2E-05	4.5E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\aspcode\models\myank82.cmp
BRANCH MODEL: c:\aspcode\models\myankee.82
PROBABILITY FILE: c:\aspcode\models\pwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	6.5E-04	1.0E+00	
loop	2.0E-05	5.8E-01	
loca	2.4E-06	5.4E-01	

sgtr	1.6E-06	1.0E+00	
rt	2.8E-04	1.0E-01	
rt(loop)	0.0E+00	1.0E+00	
afw	6.1E-03***	4.5E-01	
afw/atws	4.3E-03	1.0E+00	
afw/ep	5.0E-02	3.4E-01	
MFW	1.9E-01 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.9E-01 > Failed		
porv.chall	4.0E-02	1.0E+00	
porv.chall/afw	1.0E+00	1.0E+00	
porv.chall/loop	1.0E-01	1.0E+00	
porv.chall/sbo	1.0E+00	1.0E+00	
porv.reseat	2.0E-02	1.1E-02	
porv.reseat/ep	2.0E-02	1.0E+00	
srv.reseat(atws)	1.0E-01	1.0E+00	
hpi	3.0E-04	8.9E-01	
feed.bleed	2.0E-02	1.0E+00	1.0E-02
emrg.boration	0.0E+00	1.0E+00	1.0E-02
recov.sec.cool	2.0E-01	1.0E+00	
recov.sec.cool/offsite.pwr	3.4E-01	1.0E+00	
rcs.cooldown	3.0E-03	1.0E+00	1.0E-03
rhr	3.1E-02	7.0E-02	1.0E-03
hpr	4.0E-03	1.0E+00	1.0E-03
ep	2.9E-03	8.9E-01	
seal.loca	5.5E-02	1.0E+00	
offsite.pwr.rec/-ep.and.-afw	3.2E-01	1.0E+00	
offsite.pwr.rec/-ep.and.afw	1.1E-01	1.0E+00	
offsite.pwr.rec/seal.loca	6.5E-01	1.0E+00	
offsite.pwr.rec/-seal.loca	2.3E-01	1.0E+00	
sg.iso.and.rcs.cooldown	1.0E-02	1.0E-01	
rcs.cool.below.rhr	3.0E-03	1.0E+00	3.0E-03
prim.press.limited	8.8E-03	1.0E+00	

* branch model file
** forced
*** branch probability reflects the requirement for 2 of 3 AFW pumps for success.